ICT policy in European cities: a comparative approach

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2001

Faculteit der Economische Wetenschappen en Bedrijfskunde

SERIE RESEARCH MEMORANDA

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A Comparative Approach

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Research Memorandum 2001-25

July 2001

vrije Universiteit ***amsterdam***

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Abstract

Information and Communication Technology (ICT) is widely accepted as a potentially beneficial set of instruments, which may improve the welfare and competitiveness of nations and cities. Nowadays both public and private actors aim to exploit the expected benefits of ICT developments. This paper seeks to investigate the potential of ICT policy at an urban level, and in particular to shed more light on various factors that influence urban ICT policies in the public domain.

Firstly, we draw attention to the definition of ICT policy in order to Capture different (direct and indirect) public actions that address the ICT field so as to enable a meaningful comparison of policies among different cities. A conceptual framework, designed to improve our understanding of the driving forces of urban ICT policies, is proposed. It contains three groups of factors: personal backgrounds of decision-makers (or public actors), their perceptions of ICT, and the city's characteristics. Interviews with urban decision-makers in different European cities in 3 countries (Austria, Spain and The Netherlands) are used to analyse the relationships between urban characteristics (e.g. size, nature of problems, urban image), personal attitudes towards ICT, administrative features of the cities concemed, and perceptions of ICT conditions in cities.

The main focus of the present paper is on the identification of a possible systematic relationship between the above mentioned explanatory factors and the urban decision-makers' attitudes towards ICT policies. Understanding the decision-maker's perceptions is an important step towards the understanding of the nature of the policy itself and may explain some of the variance among different cities. Since the 'urban ICT' discourse is stil1 relatively new, an open interview method is used to capture a variety of different views and perceptions on ICT and the information age in the city. By using a qualitative content analysis, the interview results are transformed in a more systematic and comparable form. Next, an approach originating from artificial intelligence, coined rough-set analysis, is deployed to offer a more rigorous analysis. This approach helps US to characterise and understand perceptions and attitudes regarding urban policies, problems and images.

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1. Network Trends in Modern Cities

Cities all over the world are in a state of flux. We witness an urban evolution in which interaction and communication are the prominent features of a new urban edifice. These dynamic developments are a clear manifestation of a worldwide process of connectivity in which material and non-material networks play a crucial role (see also Castells 1996 and Kohno et *al.* 2000). Clearly, the emergence of the strategic position of cities in multi-layer networks induces an unprecedented development in the geography of our world with a strong tendency towards nodal spatial concentrations. Transport and communication are becoming the vehicles through which networks act as structuring pivots at various spatial scales (see Shapiro and Varian 1999; Vervest and Dunn 2000).

This observation prompts a series of intriguing research issues. What is the actual impact of connectivity infrastructure in terms of an enhancement of accessibility and an elimination of institutional impediments or physical barriers? How much is the future of a city dependent on access to or its position in a global network? And how can local information and communication technology (ICT) policy be instrumental in favouring the network character of a city? These questions can be illustrated by using the illustrative force field mapped out in Figure 1.

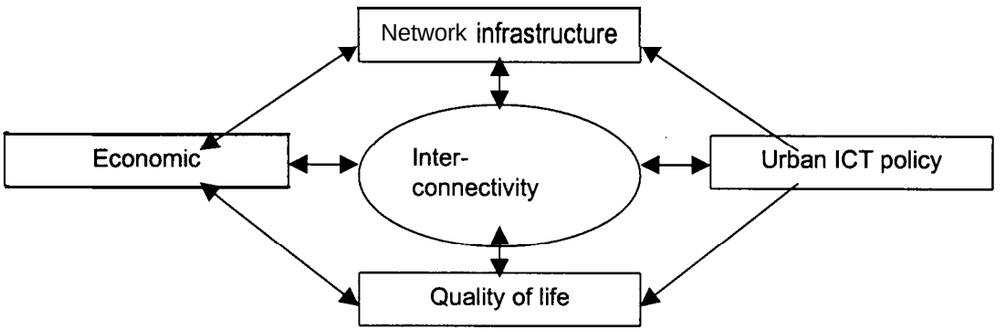

Figure 1. A force field of network impacts

The main question addressed in the present paper concerns the role of cities – and more specifically that of urban administrations – in the process of ICT development, its adoption and transmission. Consequently, we will position the urban administration at the crossroads of various interests. In recent years we have indeed witnessed a profound change in the institutional and industrial organisation of our cities. An important mega-trend has been the transition of isolationist urban location and interaction pattems to complex spatial network pattems that may be characterised as a network configuration. Such multi-layer network developments may be characterised by complex ICT pattems, by intensive mobility and interaction pattems, and by global connectivity pattems, which far exceed the conventional action radius of a static society (see also Castells 1996; Graham and Marvin 1996). This dynamic change pattem in cities partly is govemed by technological forces and partly is the result of behavioural changes. However, the public govemance of the underlying driving forces may also be an important source of drastic change in modem cities.

The result of the various spatial networks interactions leads to the 'associative city' (see also Archibugi, 2000), a city that is govemed by ICT developments that make the city a spider in a broad network of linkages, not only local/regional, but also national/global. It goes without saying that such a city will exhibit dynamic changes and will be more 'connectionist' than other localities. What are the features of such cities? Above all, what are the fine-tuned urban govemance strategies that will help in shaping the new city of tomorrow? Against this background, a comparative study on the critical success conditions of modem 'associative cities' is certainly warranted. This task requires both a theoretical/methodological reflection and empirical /policy-analytical research on revealed behaviour of various actors and on policy impact assessment.

In the context of the present paper we will focus in particular on the question of how public urban policy-makers and planners perceive the role of high-tech developments. The paper will adopt a meta-analytic approach by investigating the perceptions of key actors in urban administration in various cities in Europe. The next section will provide a further introduction to the motives behind this study.

2. Setting the Scene

The ICT sector is nowadays broadly recognised as a set of potentially beneficial technologies that could improve the welfare and competitiveness of nations and cities. Although many would argue that the main driving forces are private and not public in nature, we recognise a growing public interest in policies and strategies that induce ICT development and mobilise it in order to achieve a variety of desired public goals (e.g. national ICT policies, or deregulation and re-regulation in the ICT sector). Concepts of the 'information society' and other similar labels have stimulated many visionary plans, creative proposals and research efforts. Much of the writing on this subject reflects a picture of a future society in optimistic colours, but has failed to provide clear evidence of how to get from here to there or to explain what the consequences of the adoption of these technologies on other constellations of society will be (Melody 1996). Alongside the expectation that the private sector will play a major role in the ICT field, the envisaged ICT benefits encourage policy-makers and planners to formulate public policies, which favour the development of ICT as part of an urban or regional competitive strategy.

Following the introduction of national (and even intemational) ICT policies, at present there is growing attention for urban or local ICT policies and for the potential of local public policies to complement, induce and substitute (or even correct) national policies and private forces (Gibbs and Keite 1997; Graham 1997; Graham and Dominy 1991).

The rising importance of ICT in everyday life, business activities and govemance clearly raises the need to incorporate it in urban policies. However, the wide range of possible interventions tends to lead to different ICT policies for cities. Which factors are responsible for these differences ? To answer these issues, we address the generic question: which are the driving forces that motivate policies in general? After the presentation of a conceptual framework on the policy-making process with a clear emphasis on ICT policies, we will use in our study an open interview approach with urban planners and policy-makers in order to identify important issues regarding urban policy-making.

3. ICT Policy-making

There are two types of public ICT policies. On the one hand, dedicated infrastructure development of a generic type (supply side) is necessary to enable ICT use. On the other hand, there are policies that induce the use and adoption of ICT both in households, firms and the public sector itself (demand side). For instance, govemment adoption and use of different types of ICT are important ways of supporting the development of information and telecommunication infrastructure, to stimulate demand and to provide incentives to additional investments in the ICT sector. Other strategies for adoption may be found in education and training programs, through the facilitation of terminal equipment and so on. Singapore offers an example of a clearly targeted ICT public policy designed to attain economic growth through ICT-based strategies (Mahizhnan 1999). Figure 2 introduces the main factors and actors that affect public decision-makers' ICT policy.

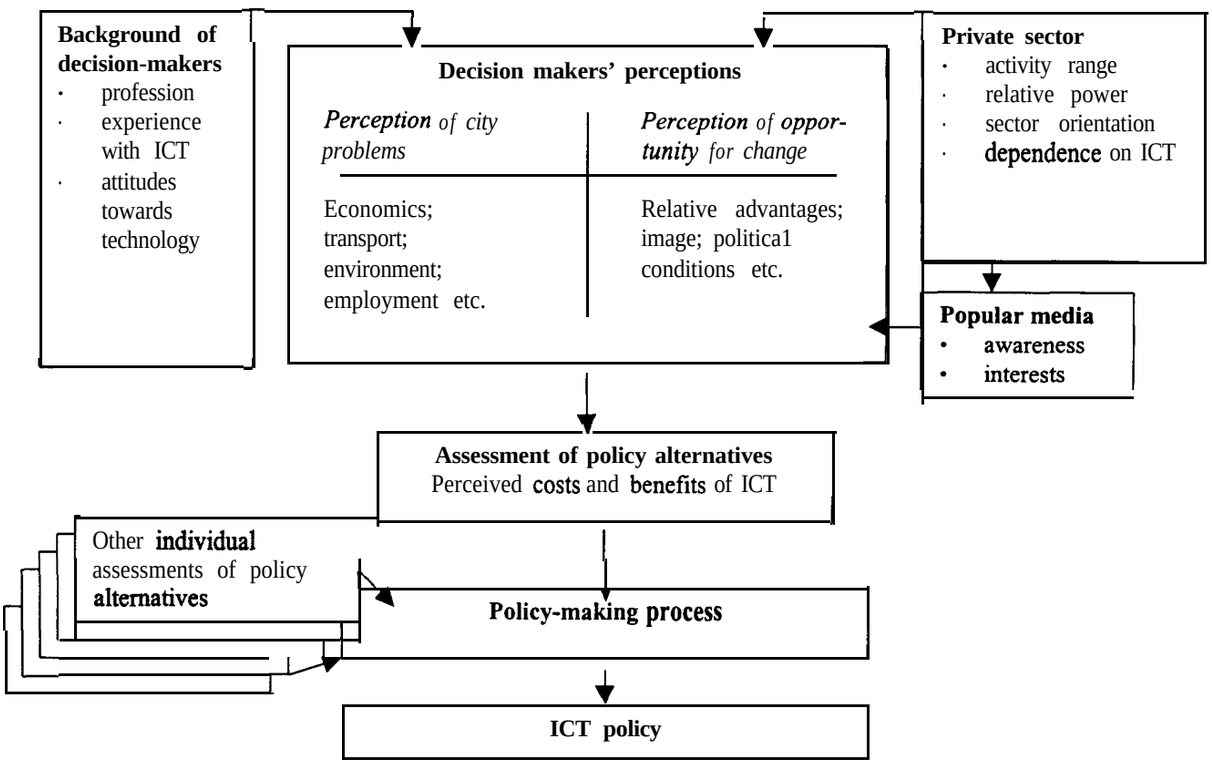

Figure 2. Factors and actors that affect public decision-makers' ICT policy

The conceptual framework in Figure 2 highlights the importance of the personal evaluation of 'facts' and 'data' (the decision-maker's perception box). It is essentially based on Vickers' models of decision-making (1965). The Vickers model stresses the importance of understanding the way in which a decision-maker constructs the *reality* (e.g., what is out there? What is the problem? What predictions can be made?) This model emphasises also the *values* (what values /norms are set? What ought to be?). The process of reality judgement and value judgement leads to action judgement or, in other words, to the idea about the policies that should or could be taken (Vickers 1965; Parsons 1995).

Figure 2 offers a description of direct ICT policies (i.e., policies in which the final policy goal addresses ICT, such as expanding the ICT infiastructure, regulating it or supplying services through ICT). We should bear in mind a second type of public activities (not shown in Figure 2) that also affect the actual public ICT policies: *indirect policies* (Cohen *et* al, 2001). Indirect policies are defined as policies that are intended to achieve non-ICT goals via the use of ICT. Examples of this type of policy is the use of ICT to disseminate information to the public via the Internet, to promote desired behavioural changes, such as public transport usage or usage of ICT in the planning process or adding computer classes to the curriculum of schools. Here, ICT is an instrument (in many cases, one of several) intended to accomplish pre-defined goals, in an indirect marmer. In such cases, the indicators to evaluate the policy are non-ICT impacts. These policies will also affect the actual ICT policy, but its 'making' process is not solely ICT-oriented and is thus slightly different from the process described in the above Figure 2.

The perceived benefits and costs in the decision-makers' mind may explain, in part, why there are different policies in different cities. Investigation of such relationships requires a comparison between background conditions in various cities (in different cotmtries). Cross-urban research enables the identification of these different attributes. Moreover, it helps US to identify possible relationships between different urban and ICT policies.

4.The Data Base for Our Analysis

In this section we will describe the database originating from the European project TeleCityVision (TCV) in an effort to investigate and compare urban ICT policies across European cities. Rather than starting with a massive quantitative data collection, it was decided to organise a round of open interviews with urban planners and decision-makers. The major reason for using the method of open interviews was to Capture, in the planners' and decision-makers' own words, their urban problems, the urban image, relevant strategies and their ideas on the future of the city and its related administration. An open interview using guided questions has a clear advantage: it can elicit additional ideas and concepts that are important for the specific issue at hand, which the researchers are not aware of. This is especially important in the ICT field, where the discourse is recent and extremely dynamic and where there is as yet no established wisdom.

However, using open interviews also has some drawbacks. First, the interviews vary and make a solid comparison a complicated task. In order to compare such open interviews, a useful way to enable a more analytical approach is to 'standardise' them to the maximum extent possible. Such a process requires reorganising the interviews, so that they have a common base, converting the information so that on the one hand it maintains the basic information, while on the other hand it allows similar answers or ideas to be grouped together. A second problem inherent in open interviews is that the interviewees tend to attach an unequal weight and importance to various questions and issues, so that not all of them give full information, and we may face cases where the interviews are incomplete.

In spite of the above mentioned limitations, we have chosen to make a systematic analysis of these interviews, since part of the information they contain could get lost without an in-depth analysis.

Our sample contains 40 expert interviews from 9 European cities in 3 countries: Austria, Spain and The Netherlands. These cities are St. Poken, Vienna, Graze, Cuenca, Valladolid, Madrid, Amsterdam, Rotterdam and Tilburg. In each city three to seven interviews were conducted with different responsible functionaries in the urban administration so that a broad coverage is guaranteed. Table 1 describes the activity fields of the 40 interviewees.

The interviews included questions regarding urban problems and images, urban policies and strategies, urban administration characteristics as well as attitudes towards ICT, the ICT role in the administration, the city and the society at large. Clearly, we expect that the specific activity field of an interviewer will affect his or her knowledge and perceptions of different aspects of the city and its relationship with ICT as well as different aspects of society. However, since in each city we covered at least two different activity fields, more than one perspective was normally represented.

Table 1: Interviewees distinguished by professional background

Activity field	Number of interviewees*
• urban planning • transport planning • housing and urban rehabilitation	15
• public relation	2
• economic development • business location • fmance and commerce activities • social welfare	11
• informatics • ICT maintenance • internal services	7
• political: advisor to mayor, lobbyist	6
• other	

*a few interviewees were active in more than one field, so that the actual number is higher than 40.

As the interviews contain much information, we decided to concentrate mainly on two main issues: urban characteristics (as perceived by the interviewees) and perceptions of ICT, and the future city and society. As mentioned above, these two variables are assumed to have a significant influence on urban ICT policies and may explain various differences. Since the information about actual ICT policies and profiles is not sufficiently comprehensive and representative in the interviews, we cannot at this stage statistically test these hypotheses, but we can at least suggest some practica1 methods to deal with the collected information.

The first stage in reorganising the interviews was to 'translate' the interviewees' open answers into more compact and systematic categories by means of a qualitative codification. The second step was to re-group these answers to more or less uniform clusters that may classify the various answers in a limited number of clusters. The criterion for grouping the different answers was based on similarity in the meaning of those answers. Thus, the analysis process was not statistical in nature, but characterised by an interpretative approach based on a qualitative content analysis (see section 5). The information collected about urban characteristics and ICT perception is presented in Annex 1, where we tried to remain as close as possible to the precise original qualitative information given by the interviewees. Clearly, since the interviews were held in the local

language, the translation into English caused some additional differences. In this Annex, also the frequencies of the answers and the number of interviewees that did not provide information on a particular topic can be found. In a later stage this codified information was also more rigorously examined with the help of a recently developed qualitative multivariate method, viz. rough set analysis.

5. Characteristics and Drivers of Urban ICT policies

This section offers a description and analysis of nine European cities according to their characteristics as perceived by the interviewees by means of a qualitative content analysis of the various interviewees.

Tables 2 to 6 map, respectively, out urban problems, urban strategies, urban images, barriers to administrative innovations and crucial factors for the future of the city that were indicated by the interviewees. As mentioned earlier, since we are concentrating on the perception of the interviewees, all tables contain information that refers to these issues as judged by the interviewees themselves. Hence, they describe their 'reality and value judgement' (in Vickers' 1965 terminology).

The difference between Tables 2 and 6 is that, while urban strategies are supposed to represent current strategies or guidelines of the city, Table 6 presents crucial factors which the interviewees perceived to affect the city. These crucial factors can be genera1 policies or developments that are not related to direct urban policies (e.g., European integration, national and European funds). In other words, the critical factors for the future of the city can be seen as the evaluation of necessary factors for the city in the light of the four previous categories.

It is also necessary to clarify here the meaning of the indices used: a number 1 indicates that only one interviewee in the city expressed a statement on the issue concemed, a number 2 indicates that at least two interviewees dealt with this issue.

Table 2: Urban problems

Clusters of urban problems	Madrid	Valladolid	Cuenca	Graz	Vienna	St.Polten	Amsterdam	Rotterdam	Tilburg
1. Land; dwellings; space; overpopulation	2	2	1			2	2	1	2
2. Low economic attraction; shortage of firms; relocation of firms					2	2	1		1
3. Budget deficit	1					1			
4. Transport problems	2	2	2	2	2	1	2	1	
5. Decline of city centre; sub-urbanisation; population decline	1		1	2		2			
6. Unemployment; low qualified unemployed	2	2	2		2		2	2	2
7. Education; lack of educated professionals					1		1	1	
8. Environment	2								
9. Negative image; fuzzy image		1	1	1	2			1	
10. Weak regional co-operation; lack of managerial platform		1			1		1		
11. Inflexible administration; conservative; not transparent;	1	1		2	1				
12. Ethnic minorities; social segregation; safety	1	2	1					2	1
13. Lack of ICT infrastructure	2	1	1						

Legend: 1: mentioned by 1 interviewee
2: mentioned by 2 or more interviewees

The genesis of a policy normally involves the recognition of a problem (Parsons 1995). As Figure 2 suggests, the definition of a problem does not solely depend on the actual issues in the urban agenda, but also on the interpretation of the 'facts'. Thus,

examining the interviewees' perception of their urban problems can supply the 'bridge' between facts about cities on the one hand, and the motivation to policy on the other hand.

Not surprisingly, the most frequent urban problem mentioned is the transportation problem. Tables 3 and 6 suggest that improving transport infrastructure is mentioned also in most of the cities as a prominent urban strategy and as a crucial factor that will affect the city's future.

The second frequently mentioned urban problem is unemployment in general, and the presence of low qualified unemployed specifically. As Spain still has a very high unemployment rate (compared to the EU15), it is not surprising to find a broad consensus regarding unemployment problems. In The Netherlands, although at present the unemployment rate is very low, the three cities considered stil1 have relatively high unemployment rates compared to the national level, and thus regard this issue as problematic in this respect. Coping with unemployment can be approached in many ways, and there is no specific urban strategy that is geared toward this problem. On the one hand, we may find strategies such as attracting active businesses, supporting high quality employment and the promotion of industrial development. On the other hand, less direct strategies, for instance, stimulation of ICT use and improvement of the city image, can be seen as other ways of dealing with unemployment.

An interesting issue that was repeated throughout the interviews is the city image. A negative image was mentioned in 6 of the 9 cities, and for many cities an important strategy appears to be the improvement of such a poor image (Table 3). It seems that in the ICT discourse the image factor is growing in importance and cities are not an exception in this respect. The idea that improving urban image by employing virtual 'realities' ,for instance, to mitigate certain urban problems, makes more and more sense in a virtual society and in the spirit of the 'virtuality' concept.

Table 3: Urban strategies

Clusters of urban strategies	Madrid	Valladolid	Cuenca	Graz	Vienna	St.Polten	Amsterdam	Rotterdam	Tilburg
1. Improve infrastructure; reduce travel	2	2	1		1	1	1	1	
2. Improve administration: taxation. administrative re-ornanisation. contact with nublic		1		2	1		2	1	1
3. Activate business attraction, new projects or business sites	2	2	1	1		1	1		1
4. Improve quality of live and urban environment	1	1						1	
5. Promote industrial develonment		2		1					1
6. Promote tourism. culture or conferences	2	2	2						
7. Reinforce capital or metronolitan nosition		2				2			
8. Renovate city centre; encourage compact city; control residential and business sprawl	1				1	2	1	1	
9. Improve image; market the city	2	1	1	1	1				
10.Support high quality employment; upgrade labour force; improve education	1							1	1
11.Reduce social gaps	2								
12.Induce ICT use and infrastructure: introduce virtual soace	2	1	1	1	1			1	1
13.Co-operate with private sector, or other municipalities					2		2		
14.Leave ICT to private sector		1			1				

Legend: 1: mentioned by 1 interviewee.
2: mentioned by 2 or more interviewees

Another important aspect that shows up in these tables is the role of ICT in the city. Three cities indicated a lack of ICT infrastructure as an urban problem. This does, however, not mean that the remaining cities are satisfied with their ICT performance; it

simply is not yet regarded as a problematic issue by the interviewees. On the other hand, in both Tables 3 and 6, the stimulation of ICT use and related infrastructure is seen as an important strategy and a crucial condition for urban development. Since public policy usually tries to address, to solve or to mitigate social issues, this phenomenon points at an interesting aspect pertaining to ICT policy. Some of these policies are adopted without a specific problem in mind, and are based on the genera1 uncritical assumption that ICT policy is beneficial. In other words, the reason for the existence or implementation of ICT policies is (in many cases) an attempt not to be a late-corner. Thus, it is not surprising to find that many planners and urban decision-makers regard ICT as a vita1 development factor for their city without relating it to a specific social goal.

The strategies summarised in Table 3 demonstrate the variety of challenges that the urban govemance has to face. Besides the above mentioned infrastructure improvement policies, the promotion of different urban activities gains importance. Thus, promotion of industrial development, promotion of tourism and cultural activities, and promotion of business activities were frequently mentioned. Less frequently mentioned strategies were those related to direct social issues, for example, reducing social gaps and improving the quality of life in the city. The specific activity field of the interviewees, who were mostly urban planners and economists, may of course bias these results.

Interestingly, the interviewees considered in particular urban strategies which could be seen as an intervention in private sector activities. Strategies from clusters 3, 5 and 6 suggest that the city should take a more active role in various aspects, and not act merely as a facilitator. Nevertheless, the most frequently mentioned strategies are stil1 related to "classic" urban policies: transportation policies and administrative improvements. Introducing ICT to the city (cluster 12) is considered as relevant in most of the cities, though the interviewees suggested different methods of intervention.

Table 4: City images

Clusters of city images	Madrid	Valladolid	Cuenca	Graz	Vienna	St.Polten	Amsterdam	Rotterdam	Tilburg
1. Positive; ; improving; satisfied; proud of the city	2	2	1	1	2	2	1		
2. For shopping and working, not for living						2			
3. High living standards; nice to live in; friendly; open	2		1	1		1	1		1
4. Chaotic; messy; congested; expensive land	1						2		1
5. Small scale; green; traditional; compact; quiet		2	2						1
6. Negative, distant and not friendly; no entertainment, high drugs abuse		1		1				2	1
7. Not an economic centre; lack of business spirit		1							1
8. Industrial; blue colour labour								1	2
9. Old fashioned; conservative; not innovative; outdated, pensioners city				2	1				1
10. Modern	1					1		1	
11. Doine business is possible								1	
12. Culture, tourism and arts centre	2		2	1	1		1		
13. Capital; intemational; gateway to Europe	2				1		1		
14. Difficult and complex politica1 conditions				1					

Legend: 1: mentioned by 1 interviewee
2: mentioned by 2 or more interviewees

Table 4 gives a picture of the 9 European cities under consideration, as suggested by the interviewees. It is easy to observe that there are many types of city images. Some are clearly positive (1, 3, 10, 1 1), some are negative (4, 6, 9) and others cannot be categorically labelled as positive or negative (5, 8, 13). In 6 out of the 9 cities, a high standard of living or a friendly atmosphere was mentioned, adding to the positive

perception of the interviewees about their city. In general, we found the most positive interviewees in the Spanish cities and the most critical ones in the Dutch cities. As mentioned earlier, a negative image was mentioned in 5 cities as an urban problem, including 2 Spanish cities. However, when the interviewees were asked about their own cities, they tended to be positive also about places where the negative image problem was raised.

As mentioned earlier, one way to induce the development and use of ICT in a city is to adopt it as part of the administration. Adoption of ICT within the administration can stimulate services via ICT channels as well expose the administration to the use of ICT applications. Table 5 presents the barriers to innovation in their administration mentioned by the interviewees (ICT-related innovations are just one possible innovative trend in urban administration). The most frequent obstacles to innovative administration were related to lack of co-operation and co-ordination (cluster 7). These problems may explain the considerable attention to administrative improvement strategies that were mentioned in Table 3 (cluster 2) as an urban strategy in the majority of cities. The wide spread responsibilities and uncoordinated actions seem to be a common challenge in contemporary cities, which have to govern a complicated urban system with multi–criteria policy goals. Here, ICT adoption can be seen as both the goal and the means. On the one hand, a more coordinated administration is required in order to induce innovations in the administration. On the other hand, ICT adoption can improve the administrative coordination and cooperation. Thus, in many cities a process of reorganisation is supported by the introduction of ICT applications. A related cluster of barriers is formed by cluster 5, which indicates the lack of a strategic plan or politica1 will to introduce innovation in general, and innovative ICT applications specifically.

The second most frequently mentioned cluster is related to budget problems and high investment costs (cluster 8). It suggests that the priority of ICT strategies or policies is not sufficiently high, or that the city stil1 has to adjust itself to this new budgetary situation.

Table 5: Barriers to administrati ive innovations

Clusters of barriers to administrative innovations	Madrid	Valladolid	Cuenca	Graz	Vienna	St. Polten	Amsterdam	Rotterdam	Tilburg
1. Data protection	2								
2. Employees' resistance; mentality.	2	1				1			
3. Conflicts of competence; need for central management	1								
4. Lack of interactivity	2	1					2		
5. No strategic plan; lack of political will; unstable political conditions	2	1	2			1			
6. Lack of qualified computer expertise, lack of effcient data supply	1							1	
7. Wide-spread resoonsibilities: lack of co-operation or coordination:	1	2	1	1	1	1	2	2	1
8. High investments; budget problems	1	1	2	1	2			1	
9. Lack of information about ICT possibilities		1							
10. No urgent need for change		1							
11. Inflexible planning system				1					
12. Too much orivatization									1

Legend: 1: mentioned by 1 interviewee
2: mentioned by 2 or more interviewees

Another interesting barrier to innovation in the urban administration is the employees' resistance to change. As in all regular workplaces, the urban administration is no

exception in this respect, since changes in the work atmosphere may threaten the employees, in particular their position in the hierarchy.

Table 6 shows the factors and forces that are believed to be crucial for the future of the city. It can be seen that both ICT and transport infrastructure are considered by many interviewees as crucial factors. Apparently, most of the urban decision-makers do not believe in substitution between ICT and transport and think that both infrastructures are necessary for city development. Here again, taking an active role in economic activities (cluster 3) was supported by interviewees in four different cities. However, maintaining high living standards and affordable housing gained also importance in different cities.

As Tables 2 to 6 demonstrate, urban planners and decision-makers perceive and represent urban characteristics in different ways. As the city is a multi-layer phenomenon, it is not surprising to find that people perceive its characteristics differently and pay different degrees of attention to its components. However, as the process described in Figure 2 has already hypothesised, the input for the policy-making process is formed by the characteristics that decision-makers perceive. Thus, to understand this process, we should examine not only 'plain data' about the city, but also the way these data are interpreted by decision-makers. Tables 2 to 6 offer information on the varied characteristics of the 9 European cities and give US some concrete ideas about relevant items on the policy agenda in these cities as a result of the urban problems, images and the perceived crucial factors for the city future.

Table 6: Crucial factors for the future of the city

Clusters of crucial factors for the future of the city	Madrid	Valladolid	Cuenca	Graz	Vienna	St .Polten	Amsterdam	Rotterdam	Tilburg
1. ICT infrastructure; diffusion of ICT use	2	1	2		2		2	2	2
2. Qualified workforce and improvement in education	1						1	1	
3. Active city marketing,; economic activism	2			2		1	1		
4. Preserve city culture and history	1								
5. Less polluting activities	2								
6. Improve transport infrastructure and cope with traffic congestion	1		2	1	2	1		1	1
7. More service-oriented administration				1					1
8. Regional co-operation					2				2
9. Maintain high living standards; real estate prices; cleaning up slums;	2		1		1			1	
10. Benefits of geographic location					1				
11. Compete with other cities to attract business						2			1
12. Funds from national government or EU							2		1
13. EU integration and opening of Eastern Europe				1	2				

Legend: 1: mentioned by 1 interviewee
2: mentioned by 2 or more interviewees

6. Analysis of Urban Features by means of Rough Set Methods'

In this section we will analyse the multi-faceted urban characteristics related to ICT in a more systematic manner and explore whether we can identify regularities in the choices or interviewees perceptions. Is it possible to infer meaningful exploratory or explanatory modes from the sample of qualitative interviews on urban ICT issues? The multidimensional categorical nature of the information with a limited number of observations forces US to resort to techniques developed in artificial intelligence. One of

[1] The authors wish to thank Gabriella Vindigni for her assistance in using the computer software.

these methods is rough set analysis. A rough set analysis approach allows US to check whether we can find a set of 'decision rules', i.e. a series of conditional statements of an "if then" nature, which act as a qualitative explanatory model for a certain endogenous variable or choice that is related to a set of various background factors. As Tables 2 to 6 show, there is a variety of possible logica1 relations among the urban characteristics and, therefore, there are many possible competing explanations for them. However, we are more interested to determine whether the existence of city-specific problems, urban strategies, city images and administrative barriers can 'explain' how and why ICT related policies are perceived as crucial for the future of a city (i.e., whether the interviewee has chosen a statement from cluster 1 in Table 6).

Rough set analysis is a non-parametric statistical method, developed by Pawlak (1991) and Slowinski (1993), to analyse smal1 samples. The aim of the rough set method is to identify regularities in the data, extract the link between them and to discover cause-effect relationships as well as underline the importance and strategic role of some data (and the irrelevance of others) (Van den Bergh et al. 1997). The analysis classifies and distinguishes data on the basis of the different values their attributes assume with reference to each object. There must be at least two of these values in order for attributes to be significant. Rough set analysis can specify various decision rules of an 'if-then' nature, which is an implication of relationships between the condition (background) and decision (response) attributes.

The first analysis in our experiment using a rough set approach aimed at checking whether certain combinations of urban problems are related to a perception that ICT is a crucial factor for the future of a city (Table 2). Each cluster of urban problems was regarded as an attribute (13 attributes) and the decision variable was set equal to "1", when the interviewee indicated that ICT is a crucial factor for the future of his/her city. The variation among the interviewees is evident here. The analysis identified a few decision rules in which interviewees indicated the same problems and also indicated ICT as a crucial factor. However, these groups are smal1 and contain only a few cases in each decision rule. For instance, there are 4 interviewees who mentioned that their city is suffering from environmental (cluster 8) problems and from land shortage (cluster 1) and proposed ICT as a crucial factor (the 4 cases are highlighted in Table 7). Another modest, but interesting decision rule contains 3 cases, where the interviewees mentioned a negative image as an urban problem, and did not mention issues from clusters 1 and 11 (land shortage and inflexible administration, respectively). These 3 cases are also highlighted in Table 7. The rest of the rules that were found contain even fewer cases and are, therefore, not considered to be strong.

The same analysis was performed with regard to the city image (Table 4). Here, 14 attributes representing 14 clusters were identified. The most important decision rule contains 4 cases as well, suggesting that interviewees who perceive their city as a capita1 city (cluster number 13) and did not choose a statement from cluster 4 (chaotic and messy city), were also the ones who indicated that ICT was a crucial factor for their city's future.

When taking into account all urban characteristics mentioned in Tables 2 to 6, the analysis leads to interesting results. Since there are large numbers of altemative clusters within each issue (the issues are urban problems, images, etc.), we have limited our rough set analysis to the 3 or 4 most frequently occurring clusters. Hence, we have created a new, complementary database. It illustrates whether the interviewee has chosen any of the 3 or 4 most frequent clusters in all 4 above mentioned urban characteristics (where we

had 13 attributes), and whether he/she has chosen cluster "1" as the crucial factor for the future city (the so-called decision variable).

Rough set analysis appeared to be able to extract now a series of decision rules. However, in our application only a few of them were related to a case where the interviewees covered more than two objects, which means that such a rule is supported by a very smal1 number of cases. Moreover, decision rules which contain more than 3 objects, referred in most cases to those statements which did not include the cluster of ICT initiatives; thus for our purpose, they are of less interest. However, we were able to identify one decision rule, which involved 6 interviewees who stated that transport is a serious urban problem and that a barrier to administrative innovation is caused by the lack of a strategic plan. These 6 interviewees also claimed that ICT initiatives and ICT development are crucial factors for the future of a city. It would thus be reasonable to conclude that such a combination means that when a city suffers from severe transportation conditions and the administration does not have innovative plans (e.g. for alternative infrastructure), such plans are perceived as important and crucial for the future of a city. Acknowledgement of the fact that a lack of strategic plans limits the capability of urban govemments could be associated with the belief that new information technologies could be used as strategic tools. Interestingly, 4 of the 6 interviewees from this group are from Madrid, and they reflect a relatively broad consensus regarding the importance of ICT initiatives in this city's endeavour to overcome its transportation problems and to improve its administrative performances.

Apart from the above mentioned group of systematic decision rules, it was not possible to find other clear regularities in the database, i.e. it was not possible to identify other rules that could explain a relationship between the urban characteristics as perceived by the interviewees. There are two possible reasons that may explain this result. The first relates to the data collection method. As described earlier, we have used open interviews in order to gain the information without enforcing our own subjective perceptions. One consequence of this method is the emergence of missing variables and partial answers, which complicates a systematic comparison. This was reflected also in the rough set analysis, which had many missing variables, thereby reducing the strength of the method.

The second reason sterns from the complexity of the urban problem, and questions whether one person can have a systematic view, opinion or perception on all issues raised. Apparently, there is a great deal of heterogeneity in the data set. It is reasonable to argue that some of the interviewees may not have any information or opinion about all these issues and thus it is fairly difficult to build a systematic reliable framework for empirical analysis.

Table 7: Urban problems and ICT as crucial factor for the future of the city

Database for rough set analysis*

Interviewee number	Land shortage	Low economic attraction	Budget deficit	Transport problems	City center decline	Unemployment	Education problems	Environment	Negative image	Lack of co-operation	Administrative	Social problems	Lack of ICT	Does ICT crucial for
1	2	2	2	2	2	1	2	2	2	2	2	2	1	1
2	2	2	2	1	2	1	2	1	2	2	2	1	2	1
3	1	2	2	1	2	2	2	1	2	2	2	2	2	1
4	1	2	2	1	2	2	2	1	2	2	2	2	2	1
5	1	2	2	1	1	2	2	1	2	2	2	2	1	1
6	1	2	1	1	2	1	2	2	2	2	2	2	2	1
7	1	2	2	1	2								2	2
8	2	2	2	1	2	2	2	2	2	2	2	2	2	2
9	1	2	2	1	2	1	2	2	2	2	2	1	1	2
10	1	2	2	2	2	1	2	2	2		12	12		1
11	1	2	2	1	2	1	2	2	1	2	1	2	1	2
12	1	2	2	1	2	1	2	2	2	2	2	12		1
13	2	2	1	1	1	2	2	2	2	2	2	2	2	1
14														
15	2	2	2	2	1	2	2	2	2	2	12	2	2	
16	2	2	2	11	2	2	2	2	2	2	2	2	2	
17	2	2	2	12	2	2	2	2	2	2	2	2	2	
18	2	2	2	2	2	2	2	2	12		12	2	2	
19	2	2	2	1	2	1	1	1	2	2	2	2	3	1
20														
21	2	2	2	2	2	2	2	2	2	2	2	2	2	1
22	2	1	2	1	2	2	2	2	2	1	2	2	2	1
23	2	1	2	2	2	2	2	2	2	2	1	2	2	2
24														
25	2	2	2	12	12	12	2	2	2	2	2	2	2	
26	11	12	12	2	2	2	2.2	2	2	1				
27	2	12	2	2	2	2	2	2	2	2	2	2	2	2
28	2	2	2	12	2	2	2	2	2	2	2	2	2	2
29	12	2	2	12	2	2	2	2	2	2	2	2	2	
30	1	2	2	1	2	2	2	1	2	1	2	2	2	1
31	2	12	2	2	1	1	2	2	2	2	2	2	2	2
32	12	2	12	12	2	2	2	2	2	2	2	2	2	
33	2	2	2	12	2	2	2	2	2	2	2	2	2	2
34	2	2	2	2	2	2	2	2	2	2	2	12	2	
35	1	2	2	1	2	1	1	2	1	2	2	1	2	2
36	2	2	2	2	2	1	2	2	2	2	2	2	2	2
37	12	2	2	2	2	2	2	2	2	2	2	2	2	1
38	12	2	2	2	1	2	2	2	2	2	12	2		
39	1	1	2	2	2	2	2	2	2	2	2	2	2	2
40	12	2	2	2	1	2	2	2	2	2	2	2	2	

● Rule 1 dark shaded : (al = 1) & (a8 = 1) => (ICT = 1);[{3, 4, 5, 30)

*Rule 2 light shaded: (al 1 = 2) & (al = 2) & (a9 = 1) => (ICT= 1); {14, 20, 24}

7. Perception of ICT, the Future of the City and the Future Society

After the analysis of the actual 'problematique' of modem cities, we will now turn to the question how relevant ICT is to the future of cities. In this section we will address the perceptions and attitudes towards ICT, the information society and its importance for the future city. These perceptions may influence the way decision-makers acknowledge the opportunities and obstacles of policies in general, and ICT policies in particular.

In their book, Graham and Marvin (1996) put forward four perspectives and approaches for dealing with new technologies (and ICT specifically) in the city.

Technological determinism tends to assume simple linear relations between technological causes and urban effects. This approach is based on a linear notion that

irmovation leads to new technologies that - when applied - impacts on society. In other words, the hidden assumption in those predictions is that if technology has the ability to affect the city in a certain way, it will affect it.

Utopianism-futurism predicts the technological future of cities, households and society. It tends to take a relatively optimistic view of the future impact of telecommtmications on cities and urban life. Where negative effects emerge, they can often be solved through new technologies.

Dystopian/urban politica1 economy relates the application of ICT to society and the capitalist world. ICT supports a wider process of economic, politica1 and spatial restructuring. The neo-Marxist stream also argues that ICT implementation is driven by the economic forces of capitalism and the need to overcome crises that reflect its inherent contradictions.

Social andpolitical construction of technology sees technology as part of society and determines how human, social and politica1 processes can shape the way in which ICT is developed and applied in society. Individuals, social groups and institutions are seen to have a degree of freedom in shaping the development and applications of technologies in specific cases.

In our fieldwork, we have tried to identify different perceptions of ICT and the city (and society in general) and to check whether the above classification can be applied to the interviewees. The perceptions are described in the Annex in Table A 3. The varied answers and reactions to the questions *"what is the information society? How will it affect the city and the society?"* reflect the wide range of perceived ICT impacts on society. As each interviewee could choose more than one statement, more than 90 different statements were given. Using a qualitative content analysis, these statements were grouped into 24 clusters.

Should we be surprised to find that the most frequent group of statements (21) belongs to the social and politica1 construction of technology approaches? Is the complex interaction between technology and society intemalised since the beginning of the nineties, when the first two of the above four approaches were prevalent? The answer is not entirely clear. On the one hand, we may claim that the attitude to those new technologies is changing due to the fact that as the 'future' comes closer, it also becomes more realistic. Naturally, predictions about a completely new technology suffer from a higher degree of uncertainty (and tend to be more extreme) than predictions about technology already in use. Unlike the 1980s and early 1990s, technologies are in place and are adopted rapidly, but the spatial consequences do not appear immediately. Thus, attitudes towards ICT and expectations about its influences are not totally divorced from the society that is adopting it.

On the other hand, most publications mentioned in Graham and Marvin's book as belonging to the first two approaches did not originate solely from urban planners or related social science experts, but also from other sources (although the book did not explicitly mention the background of the different authors). They may represent a different 'sample' of views and visions than that in the current research. As Graham and Marvin point out, the first two approaches are fuelled by the vast interest in technology and service companies (Graham and Marvin 1996, p. 111).

We will now deploy the above notions as a frame of reference for our comparative empirical research. In our research effort, the statements regarding attitudes and perceptions of ICT, cities and society were grouped into 22 clusters. There are 5 types of clusters, as Figure 3 shows: clusters related to the increase in information (1-2);, clusters

related to society and ICT (3-8); clusters dealing with spatial changes and ICT (9-14); clusters about working and education in the information age (15-18), and a fifth group including a cluster of remaining issues (19-22).

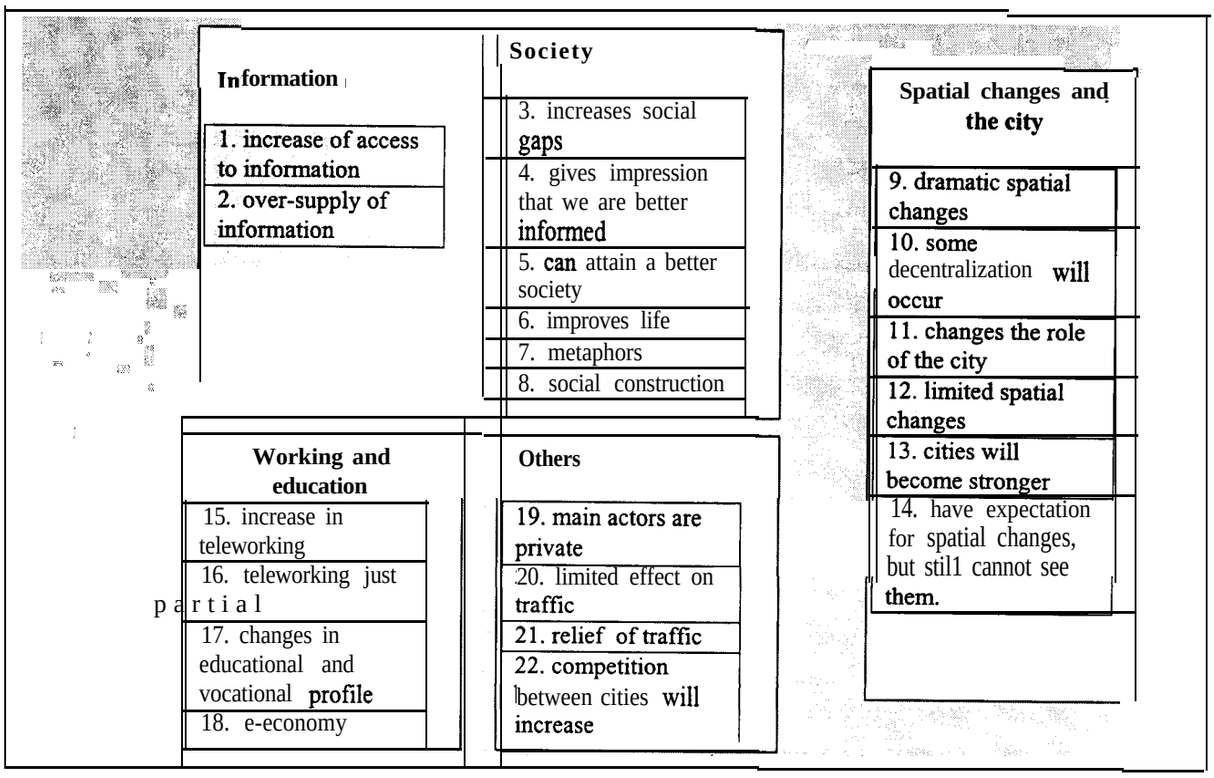

Figure 3.22 clusters of ICT perceptions.

The impression from the interviews is mixed and complicated. Indeed, some statements can be grouped into cluster 9 (indicated by 14 interviewees), which seem to belong to the more extreme approaches, i.e. those who foresee a more revolutionary and determined change. On the other hand, 19 interviewees appear to support cluster number 12, which contains more limited ICT effects on the future city. Moreover, some of interviewees, who had chosen statements from cluster 9, added a more sceptic counter-statement to 'balance' their view.

Table 8 offers a graphical representation of the different groups of statements offered by each interviewee. We can see, for example, that the interviewees numbered 15, 30, 33 and 39 have chosen statements from both groups 9 and 12. Since the statements grouped in cluster 9 are characterised by revolutionary and extreme changes due to ICT and the statement in cluster 12 offers some more modest changes, choosing from these two groups may be seen as a contradiction. Furthermore, 5 interviewees have apparently chosen both statements from group 9 and 13 (18, 21, 23, 33, 36), which again counter-balance (not to say, contradict) visions, since forecasting a strengthening of the city (cluster 13) seems to be a continuation of the current trend and not a revolutionary development. These views thus represent the complicated and confusing expectations from new technologies.

The fact that 11 interviewees have chosen a statement from cluster 14 (which includes one on the absence of current spatial changes due to ICT) gives another indication of the cautious and sceptic approach towards urban ICT implications.

Table 8: Perceptions of ICT and the society/city*

Int. No.	**Clusters of ICT attitudes and perception** (see the detailed clusters use on Table A4 in the Annex).																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
2	+												+										Madrid
4														+									
6								+						+		+							
8	+			+									+										Valladolid
10			+																				
12						+						+			+						+		Cuenca
14					+						+												
16			+						+	+	+			+									Graze
18									+		+		+										
20	+		+									+								+	+		Vienna
22		+		+	+						+												
24	+							+	+	+	+	+											
26	+				+	+				+	+	+			+		+				+		St. Polten
28	+			+					+	+				+									
30					+				+			+											A'dam
32								+				+	+										
34											+	+	+			+							R'dam
36									+				+										
38			+			+							+			+							Tilburg
40	+									+		+											

*1-22: clusters number
1-40 interviewees.

Many interviewees (15) appear to have chosen statements that belong to group number 1, which concentrates on the increase in and easier access to information. However, 3 of them also indicated the over-supply of data (cluster 2) and another 2 have chosen statements from cluster 3, which deals with the segments in the society that cannot benefit from increasing access to information.

Those interviewees who explicitly considered the transportation consequences of ICT (clusters 20 and 21) tended also to be sceptical here, realising that ICT can be mobilised to meet transport problems, but only to a limited degree. Again, this gives quite a different picture to the substitution effect assumption that was common until the early eighties (Salomon 1998).

Like in the previous section, also here a rough set analysis was employed to test whether we can identify regularities among interviewees with similar perceptions in regard to the importance of ICT for the future of a city. Since there are 22 clusters and there is a limit of 20 maximum attributes in the current software, clusters 19 and 22 were

eliminated (also since they have just one case each). Here too, the decision variable was whether the interviewee mentioned ICT as a crucial factor for the city's future.

The rough set analysis identified a few groupings of decision rules. One rule that easily can be identified involves 4 where statements from cluster number 21 (relief of traffic) were chosen and where ICT was also indicated as a crucial factor. Interestingly, all interviewees who believe that ICT could relieve transportation problems, perceived ICT to be important for their city.

Another rule covering 5 cases grouped together interviewees who did *not* choose statements from clusters 14 and 7 (expectations for spatial changes and usage of 'information society' metaphors, respectively), but did choose statements from cluster 5 (attainment of a better society). Here again, relatively optimistic expectations are correlated with the belief that ICT is crucial for the future of the city.

Another interesting decision rule regards those interviewees who did *not* indicate that ICT is crucial for the city future. The rule, with 8 cases, includes interviewees who mentioned a statement from cluster 13 (cities will become stronger) and did not mention statements from clusters 5,10, and 1 (can attain a better society; some decentralisation will occur, and increase access to information, respectively). Apparently, this was a combination of the attitude that the city will become stronger and the absence of acknowledgement of possible social benefits, characterising the interviewees who did not mention ICT as a crucial factor for the city.

Table 9: Perceptions of ICT distinguished according professional background of interviewees

Field / Cluster	Urban, transport planners (15)	Public Relations (2)	Economics (11)	Informatics (7)	Others + Politicians (5)
1	5	0	4	1	3
2	4	0	0	0	0
3	4	1	0	1	0
4	1	0	0	0	2
5	4	0	3	2	0
6	4	0	1	0	1
7	0	1	2	1	0
8	0	1	1	1	0
9	6	1	2	2	2
10	2	0	3	0	2
11	5	0	1	4	1
12	7	0	8	2	2
13	5	1	5	2	2
14	3	0	3	2	3
15	3	0	0	1	1
16	1	0	0	2	0
17	1	0	3	0	0
19	1	0	0	0	0
20	3	0	0	0	0
21	2	0	0	1	1
22	0	0	1	0	0

Does the activity field of the interviewees affect their attitudes to and expectations from ICT? Table 9 contains information about the clusters of ICT perception according to the activity field of the 40 interviewees[2]. We were able to find perception groups, which were over-represented in a certain activity field. Eight of the eleven interviewees that are

[2] When an interviewee had more than one activity field, the main activity field was taken into account

active in the economic field (see Table 1 for a detailed description) appear to have chosen statements from cluster 12, pointing out the limited spatial effects of ICT.

On the other hand, from the 15 urban, transport and housing planners, 8 have chosen statements from cluster 12, but another 6 have chosen statements from clusters 9, and a fùrther 5 chose statements from cluster 20, which represents a much higher expectation on spatial changes due to ICT. Surprisingly, it suggests that interviewees who are active in the economic field tend to anticipate less dramatic changes in the future city than urban planners. However, apart from the strong representation of economists in our sample, who chose statements from cluster 12, we could not find convincing evidence that professional background significantly affects the interviewees' attitudes and perceptions of ICT.

8. Conclusions

In order to understand the process of ICT policies in cities, we have offered a conceptual model to illustrate the complex ICT policy-making process. This model stresses the importance of decision-makers' perceptions of urban characteristics and at the same time, the relationships between ICT and the city. In Section 5 some empirical evidence for a limited sample of European cities was presented, demonstrating the varied ways in which decision-makers and planners perceive their urban characteristics. In this way, these findings shed some light on contemporary urban issues in Europe.

In Section 6 we examined the various attitudes towards ICT and its role in future society and the future of the city. Although we were able to identify various clusters of attitudes, we also found that frequently, the interviewees combined a mixture of statements from different clusters. This mixture represents a set of complicated visions and beliefs about the future city, suggesting sometimes a relatively sceptical approach towards ICT and its expected benefits.

We were also able to identify, by employing rough set analysis, a few regularities in our database, suggested by the decision rules with regard to the perceptions of the ICT role in the future city. Here, there are some indications that high expectations from ICT led the interviewees to state that ICT is crucial for the urban future. On the other hand, anticipation of a further increase in the importance of cities, together with the absence of clear social benefíts from ICT, distinguished a large number of interviewees who did not indicate ICT as crucial for the city.

However, regardless of the relatively limited expectation patterns, most of the interviewees stressed the importance of ICT for the city. In Section 7 we have presented evidence of the perceived significance of ICT for the future of the city. On the one hand, "the future is urban" as one interviewee stressed; on the other hand, "ICT is crucial for the city" and will play a leading role in the information society as "cities are the pot in which all the information melts together", in the words of other interviewees.

This paper aimed to find some empirical evidence for the 'what' and 'why' questions. What are the perceived urban characteristics and what are the attitudes to and expectations from ICT? The next step will have to deal with the 'how' questions: how do these different characteristics and attitudes affect ICT policies in cities? This will require a more rigorous explanatory framework, in which qualitative and categorical information will have to be put together. Interesting methods to be adopted here are rough set analysis, logit analysis and discriminant analysis as well as path modelling.

Acknowledgements

We would like to thank our colleagues from the European TCV project for enabling us to use the interviews from Spain and Austria.

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Annex 1

Table Al: clusters of city problems and city strategies

code	City problems	counts	code	City strategies	counts
1.	• Shortage in dwelling , Lack of space • high land prices • Overpopulated areas • Lack of green areas	18	1.	• Improve transport infrastructure • reduce travels	9
2.	• Difficult to attract industry • Lack of production firms • Relocation of firms • Deficit in businesses ·location • Not friendly for investors • Not attractive to businesses	7	2.	• Improve tax collection • Reduce public expenses • closer to the citizens • Administration Re-organisation toward more service oriented • Decentralise administration into districts	8
3.	• Budget deficit;	2	3.	• Use geo-strategic advantages • Attract international business activities; Develop original projects • become a service centre • More active approach towards siting of new companies • Become a European business centre • Replacement of deserted industrial area with new activities	9
4.	• Traffic • Transport infrastructure • Lack of public transport	23	4.	• Improve quality of life • attract Yuppies • Improve urban environment	3
5.	• Decline of city centre • Sub-urbanisation of business and houses • Density decline • Population decline • Maintenance of historic sites	6	5	• [illegible] • become centre for high quality industry • Promote industrial development • keep focusing in manufacturing • Promote specific clusters of industry	4
6.	• Unemployment • Low qualified unemployment	17	6.	• promote the city as a conference city • promote cultural projects • Become tourist attraction	7
7.	• Education • Lack of educated professionals • Low average education	3	7.	• Reinforce its position as a capital • Becoming a metropolis	3
8.	• Environment	7	8.	• Renovate core city; protect historic sites • Keep commercial activity within the city • Limit the unstructured development of trade and shopping centres • Sustainable development • Multifunctional planning (mix land use); Urban concentration; compact city	7
9.	• Negative image • Image: too small • Lack of clear identity • No clear belongs to east or west	6	9.	• Straighten the image of the city • improve information about the city to attract foreign investments • Improve position among European big cities • Active city marketing • become modern European city • new urban image	6
10.	• Weak regional co-operation • Lack of managerial platform	3	10.	• Support high quality employment • education is important • Upgrade labour force	3
11.	• Inflexible administration • Too rigid planning legislation • Conservative • Not enough contact with citizens • Not transparent	5	11.	• reduce social gaps	2
12.	• Ethnic minorities • Social segregation • Youth security, Safety	7	12.	• Introduce the concept of virtual space • modern multimedia activity • Deployment of ICT for urban planning • impmve ICT infrastructure • Active ICT provider	8
13.	• Lack of ICT infrastructure	4	13.	• Remain active alongside the private forces • Co-operate with neighbour communities • Co-operate with the private sector	4
0	Not available	1	14.	• Leave ICT to the market	2
			0	Not available	3

Table A2: Clusters of city images

code	City Image	counts
1.	• positive · Improving image · Satisfied · Proud of their city	11
2.	• **Shopping** and working **centre,** but living in the suburbs	2
3.	• High living standard · **Nice** to live · Pleasant city · Welcoming, open	7
4.	• Chaotic · **Messy** · Hard to live in · Congested · Over-extracted housing **market** · Land is expensive	5
5.	• **Small scale** · **Green** · Traditional • **Quite** · Compact	6
6.	• Not positive · Negative · Distant and not **friendly** · No entertainment · High drug abuse	5
7.	• Not attracting for **firms** · **Lack** of business spirit · Not an **economic centre**	2
8.	• Industrial city · Hard Labor	3
9.	• Old fashion · Outdated · Pensioner's city · Conservative · Not innovative	4
10.	• Modem	3
11.	• Doing business is possible	1
12.	• Culture and leisure **centre** · Tourist attraction · **Art centre**	7
13.	• **Capital** · International • Gateway to Europe	5
14.	• **Difficult** and complex politica1 conditions	1
0	Not available	5

Table A3: clusters of administration barriers and crucial factor for the city future

code	Barriers to administrative innovation	Counts	code	Crucial factors to the future of their city	counts
1.	• Data protection	2	1.	• ICT infrastructure and introduction • Diffusion of ICT use • High quality working and residence ICT infrastructure	17
2.	• Employees resistance • Mentality problem • Age of the workers . Unwillingness to accept altemative ways of working (Teleworking)	6	2.	• Qualified workforce • Improve education	3
3.	. Conflicts of comnetence • Need for centra1 management of ICT	3	3.	• Active city marketing policies • Improving city image to attract activities • Economic activism • Induce tourism and culture	7
4.	• Lack of interactivitv	4	4.	• Reserve city culture and history	1
5.	• No concrete plan, strategic plan . Lack of politica1 will . Not enough politica1 pressure • Unstable politica1 conditions	8	5.	• Less pollution activities	3
6	. Not enough qualified computer people . Efficient supplv of data	2	6.	• Improve transport infrastructure • Deal with traffic congestion	10
7	• Spread responsibilities . Lack of co-ordination • Lack of co-operation with the province, neighbour communities . Not enough administration responsibilities . Need to structural changes in the administration	11	7.	• More service oriented administration	1
8	• Need high investments . Budget • High infrastructure costs • Need to brake monopolists	9	8.	• Regional co-operation	5
9	. Lack of information about ICT possibilities	1	9.	• Maintain high living standards • Lowering real estates prices • Clearness of slums • New meeting places for people who work at home	6
10	• No urgent need for changes	1	10.	• Utilities geographic location	1
11	. Inflexible planning system	1	11.	• Compete with other city to attract businesses	4
12	• Over-privatise trends	1	12.	• Funds from national government • Funds from EU	3
0	Not available	13	13.	• Depends on EU integration and the opening of Eastern Europe	5
			0	Not available	6

Table A4: Clusters of ICT perceptions

	ICT perception		
1.	• Increases access to information • Oversupply of information · Facilitated access to information	• Easy to receive data · Acquisition of knowledge is easier	13
2.	· Often , oversupply of data	· Often waste of time	4
3.	• Increases unbalance, strengthen privilege loeations • Low qualified persons do not perceive any use of it • Generation problems.	· Only certain levels of society have access to information • Information is still socially differentiated · Only the informed will be successful; Two classes society	6
4.	• Gives the illusion that you can solve problems more efficiently	• Manipulation becomes easier · Worried	3
5.	• Chance for equal social rank • Can attain a better society • Makes people more critical • We must grasp the positive aspects and protect from the negative ones · Supply a better education	· Every body can have the same access to everything without any physical movements · Makes people more open minded • The faster we adjust to the situation, the better education will be	5
6.	· Enable more leisure time • Support social development · Motor for development	· Way to improve the quality of life · Creates additional possibilities	6
7.	· Virtual society · Connected society	· The world becoming a virtual village	4
8.	• Foster the way of life · Adoption of ICT depends on the population	· Society adapts to ICT	3
9.	· Distance no longer plays a role · The classical industrial location has disappeared · All enterprises are managed by using fully informational methods through ICT · Being close to the city is no longer a pre-requisite	· Changes everything (professional and private life) · Dramatic, revolutionary changes, faster faced life · Felt in all parts of human activity · Need to think in different terms · New forms of communication · Spatial changes will appear	14
10.	· Some back offices will move to less expensive areas · Business will need fewer central locations	· Various forms of economic activities become more footloose · Decentralisation of work will occur in certain branches	7
11.	· The city needs to develop high quality ICT infrastructure locations combined with leisure functions · Smaller cities are in more difficult position as there are less leisure and cultural activities · Can attract tourism	• The city can take different roles · The role of the city changes, it becomes more a cultural role than of economic role · City will become multifunctional · Can change spatial and economic circumstances · More balance behveen village and city	11
12.	· Limited effects on traffic and decentralisation · Spatial changes are still linked mainly to transport · City will have the same position · ICT has not changed the city morphology · Manufacturing is still essential to the urban economy · The city will still be attractive for industry	· Personal contact will remain important · ICT will not replace human contact · Traditional industries still have high location related investment costs; firms still want to locate in hotspots. • Other reasons are pushing firms and HH outside the city · Most firms stay at the city or its surroundings	20
13.	· Cities will play a larger role for the region · The future is urban · ICT are crucial for the city, the city needs it · The city will be a stronger supplier of services · The city is becoming a service centaur	· Cities are the pot in which all the information melts together · The city will be the producer and provider of information · The city has a leading role; big city is suitable for such a society · the changes are mainly occuning in the city	16
14.	· Cannot , still identify decentralisation process	· Expectation that it would affect physical movements but still cannot see it.	11
15.	· Many teleworkers · Teleworking can be induced	· Flexible workers	5
16.	· education is an important fields to implement ICT · Created new high quality jobs	· Teleworking is not relevant · Teleworking can be done partial	3
17.	· The qualification and educational facilities are very important	• Vocational profiles have changed drastically	4
18.	· Induce specialisation · e-commerce is especially important	· Easier economic relations · All the enterprises are managed fully using informational methods	3
19.	· The main actor is private, not the govemment	·	1
20.	· Due to more flexible working hours, can reduce pick traffic, to a limit degree	• Can help mitigate transport problems, but cannot solve them · Can make the transport infrastructure more efficient	3
21.	· Can relief traffic · Transportation is an important fields to implement ICT	· Less car travels	4
22.	· Competition between cities will increase	·	1